terday a flock of fish ducks sat on the ice over what was an air-hole the day before, and consequently covered with thin, transparent ice. Whether they saw minnows and perch swimming underneath I don't know, but they were motionless for an hour or more. Sailors say the lake is frozen across to Michigan, but that idea is nonsense and is exploded by the fact that my "pillar of cloud" is over the eastern horizon just the same, which it would not be but for open water.

REMARKABLE METEORS.

By Lieut. FRANK H. SCHOFIELD, U. S. Navy.

The following report, as kindly communicated by the editor of the Pilot Chart, is dated U. S. S. *Supply*, at sea, latitude 36° 20′ north; longitude 127° 36′ west, February 28, 1904:

1. I have the honor to report that three somewhat remarkable meteors were observed from this ship at 6:10 a. m. (Greenwich mean time 3 hours 12 minutes) February 28, 1904, in latitude 35° 58′ north, longitude 128° 36′ west.

2. The meteors appeared near the horizon and below the clouds, traveling in a group from northwest by north (true) directly toward the ship. At first their angular motion was rapid and color a rather bright red. As they approached the ship they appeared to soar, passing above the clouds at an elevation of about 45°. After rising above the clouds their angular motion became less and less until it ceased, when they appeared to be moving directly away from the earth at an elevation of about 75° and in direction west-northwest (true). It was noted that the color became less pronounced as the meteors gained in angular elevation.

3. When sighted, the largest meteor was in the lead, followed by the second in size at a distance of less than twice the diameter of the larger, and then by the third in size at a similar distance from the second in size. They appeared to be traveling in echelon, and so continued as long as in sight.

4. The largest meteor had an apparent area of about six suns. It was egg-shaped, the sharper end forward. This end was jagged in outline. The after end was regular and full in outline.

5. The second and third meteors were round and showed no imperfections in shape. The second meteor was estimated to be twice the size of the sun in appearance, and the third meteor about the size of the sun.

6. When the meteors rose there was no change in relative positions; nor was there at any time any evidence of rotation or tumbling of the larger meteor.

7. I estimated the clouds to be not over one mile high.

8. The near approach of these meteors to the surface and the subsequent flight away from the surface appear to be most remarkable, especially so as their actual size could not have been great. That they did come below the clouds and soar instead of continuing their southeasterly course is also equally certain, as the angular motion ceased and the color faded as they rose. The clouds in passing between the meteors and the ship completely obscured the former. Blue sky could be seen in the intervals between the clouds.

9. The meteors were in sight over two minutes and were carefully observed by three people, whose accounts agree as to details. The officer of the deck, Acting Boatswain Frank Garvey, U. S. Navy, sighted the meteors and watched them until they disappeared. He sent a messenger to me who brought an unintelligible message. When I arrived on the bridge the meteors had been obscured for about one-half of a minute.

PRECIPITATION FOR TWENTY-NINE YEARS AT DODGE CITY, KANS.

By E. D. EMIGH, Official in Charge.

In studying the adaptability of a climate to the requirements of any particular crop, only the data for the germinating and growing season should be considered. It is not an uncommon mistake to base conclusions upon figures showing the total precipitation and mean temperature of the entire year, whereas, the applicable data probably covers a period of not over six months. For facility in this work, figures for each month and each quarter of the calendar year have been compiled.

Amounts of moisture that would not be sufficient to be of great practical value in the hot months are frequently of very great importance when received by the soil at a more favorable season. Heavy snow slowly melted, or a gradual soaking rain at a time of comparatively inactive evaporation, is more beneficial by far than the heavy downpours so common to the summer months. In this connection it is interesting to note that the large wheat yields of 1892 and 1903, in Ford County, were produced under conditions of deficient rainfall, not only for the year, but for the crop season as well. In both instances the soil was blessed with an unusually abundant supply of moisture early in the season, and was subsequently benefited by timely rainfall.

After a careful investigation of the records of this station, published herewith, and of the records of the western third of the State for sixteen years, we feel justified in making the statement that there is no foundation in fact for the assertion that the rainfall in western Kansas is increasing from year to year.

Precipitation, Dodge City, Kans.

Year.	First quarter.	Second quarter.	Third quarter.	Fourth quarter.	Annually.
	Inch.	*Inch.*	*Inch.*	*Inch.*	*Inch.*
1874	.....	.....	.....	0.56	.....
1875	0.26	3.70	6.66	0.15	10.77
1876	3.64	3.84	5.42	2.50	15.40
1877	0.99	12.26	6.38	8.26	27.89
1878	2.35	7.88	6.85	0.88	17.96
1879	1.12	5.70	8.45	0.16	15.43
1880	0.04	5.03	9.49	3.88	18.44
1881	2.28	16.97	10.55	3.75	33.55
1882	0.98	6.03	4.26	1.84	13.14
1883	2.28	12.12	9.59	4.51	28.50
1884	2.27	13.21	11.45	3.43	30.36
1885	1.74	7.48	11.31	3.18	23.71
1886	3.78	7.77	6.86	0.94	19.35
1887	0.77	10.15	3.42	1.37	15.71
1888	1.89	12.10	7.85	1.10	22.94
1889	3.41	7.09	5.02	3.65	19.17
1890	0.86	5.09	4.24	1.53	11.72
1891	4.57	12.39	11.08	4.30	32.34
1892	3.88	6.97	6.39	2.42	19.66
1893	0.36	2.11	6.88	0.77	10.12
1894	1.47	5.63	4.23	1.27	12.60
1895	4.15	7.20	7.32	1.64	20.31
1896	0.74	8.61	7.20	3.32	19.87
1897	4.08	7.01	7.57	2.92	21.58
1898	2.68	15.85	8.56	4.37	31.46
1899	0.75	13.22	8.77	5.71	28.45
1900	1.74	8.90	9.02	1.10	20.76
1901	1.41	7.83	5.06	1.76	16.06
1902	2.08	6.60	5.95	3.07	17.70
1903	3.62	6.34	2.95	2.36	15.27
Averages:					
Rainfall	2.07	8.45	7.19	2.64	20.35
Rainy days	16	25	20	14	75
Temperature	34°	64°	74°	43°	54°

A rainy day is one with 0.01 of an inch or more of precipitation.

Total amount in the wettest year, 33.35 inches in 1881.

Total amount in the driest year, 10.12 inches in 1893.

Total in the wettest first quarter year, 4.57 inches in 1891.

Total amount in the driest first quarter, 0.04 inch in 1880.

Total in the wettest second quarter year, 16.97 inches in 1881.

Total in the driest second quarter year, 2.11 inches in 1893.

Total in the wettest third quarter year, 11.45 inches in 1884.

Total in the driest third quarter year, 2.95 inches in 1903.

Total in the wettest fourth quarter year, 8.26 inches in 1877.

Total in the driest fourth quarter year, 0.15 inch in 1875.

Wettest month was May, 1881, with 12.82 inches.

Driest month was December, 1889, with none.

Greatest average monthly number of rainy days, 10 in June.

Least average monthly number of rainy days, 4 in January and November.

Temperature: Annual mean, 54°; warmest month is July, with an average of 78°; coldest month is January, with an average of 28°.

Though the successive periods from the sowing to the maturing of winter wheat overlap to a certain extent, in this region they conform quite closely to the calendar quarters, and it is mainly on this account that this division of the year was selected for the above table. The fact that the growing season for our principal spring crops, oats and barley, ends late in June or early in July also makes this method more desirable for the study of climate and crops than the seasonal division of the so-called meteorological year.

To summarize in a brief and general way, July, August, and

September are months of harvesting and thrashing, followed by the preparation of the soil for fall-wheat sowing and the beginning of sowing. October is devoted to the completion of fall work in the field, and November and December to germination, a considerable growth sometimes being obtained ere the end of the quarter, for use as winter pasture. Upon the precipitation during the first quarter of the calendar year, and especially in February or March, depends to a great extent the prospects of the wheat crop; this might, perhaps, be termed the rooting season, for growth to the jointing stage is not permitted for fear of destruction by frost; spring-grain sowing is well advanced by the end of March. The wettest quarter of the year is April, May, and June, which constitute the growing season for all small grains, and the end of June usually witnesses the maturity of winter wheat and the close approach of the end of the oat and barley season.

Since irrigation water is not available in this section, and since no dependence can be placed upon the weather in July and August, which months are often dry and always hot in the daytime, the farmer relies principally upon produce that develops beyond danger early in the summer. It is necessary, however, to have fodder and hay with which to supplement buffalo grass pasturage in case of severe storms or scarcity of grass, and it is, therefore, customary to plant considerable corn, cane, and Kafir corn. Corn is planted, not with the expectation of securing a grain crop, though the profits from an occasional favorable season are perfectly acceptable, but for the more certain returns from its fodder. The most important hay crop in this region is alfalfa, to which all available bottom land is sowed, and from which three or four crops of hay are secured each season.

These remarks apply to southwestern Kansas, where the climate is different in many respects from that in other portions of the State. The much greater rainfall in the middle and eastern sections of the State permits the raising of immense corn crops in the most favorable seasons, and good crops in average seasons, as also numerous other agricultural products that can not be successfully grown in the western portion of the State.

DETAILED CLOUD OBSERVATIONS IN COLORADO.[1]

By J. B. WILLSEA, Voluntary Observer, Fruita, Mesa County, Colo., dated February 10, 1904.

For a dozen years past almost all the relaxation I have enjoyed has been in studying the clouds, but without the aid of teachers, books, or instruments. This is my only excuse for writing you. One of your assistants may find a kernel of grain in the chaff I present and be able to use it in his own special line. I never saw any of the facts mentioned below in print, nor heard them from others.

The top of a fleecy cloud leans in the direction it is traveling, because the top travels faster than the bottom, it being less affected by the friction of the air against the earth's surface.

The sun's rays sometimes seen in the east at about sunset, converging at a point diametrically opposite the sun, are parallel, and are lights and shadows of clouds in the whole sky and of mountain peaks and ridges, in this locality, projected through the atmosphere to its outermost visible limits, but the rarity of the upper air and its freedom from color prevent apparent focusing of the rays in the east.

The motion of a cloud in a vertical direction is sometimes quite rapid, for I have watched a fleecy cloud rise from the hillside and within an hour become a high cirro-cumulus.

When a rain cloud is rapidly rising, the under side is frequently covered with small, curling masses of vapor, especially in showery weather, resembling in shape the swirls or boiling of the water in the wake of a steamer. Of course this indicates a rising barometer, but I have no means of determining whether a cloud is approaching the earth or not, save by its increasing density.

I have never seen a cumulus cloud increase in size at the bottom; the increase was always at the top. Cumulus clouds sometimes rise to an immense height, cirro-cumulus appearing far below them.

The reflection of a cloud in a still lake appears larger than the original cloud.

In looking at a colored sunset, if the head is inclined so far to one side that the eyes are upside down, the colors appear much more brilliant.

The appearance of the clouds at a distance, where by reason of the curvature of the earth they touch the horizon, proves the sphericity of the globe. Otherwise the clouds would appear smaller and smaller until they became telescopic; but they do not.

The sphericity of the earth is shown by the sunset tints lingering much longer in the northern part of the horizon in the summer and in the southern part of the horizon in the winter than would be the case if the shape of the earth were not spherical. We can see the longer day to the north of us at sunset in summer and the same to the south of us in winter. I do not refer to the clouds, but to the tints of the clear sky, visible to a great distance.

At morning and at night at certain seasons of the year, there is seen apparently a portion of a cloud hanging down from the main cloud something like a beard, and resembling rain, but not having the even, clear, direct lines of descending rain seen at a distance. It puzzled me for years, but on seeing the phenomenon with tall cliffs as a background, I saw that the precipitation left the cloud as snow, but was melted to rain long before it touched the earth, perhaps even evaporating before reaching the ground. This occurs when much of the sky is clear and with isolated clouds mostly, where the clear sky furnishes a good background for observation.

I find that the thermometer shelter used by the cotton-belt observers has one fault; the rain fills the horizontal crack at the top of the door, and at night time the door freezes fast to the casing, so that damage is done in opening it. I have had no further trouble since I bevelled off the top of the door a little, thus allowing the rain to flow away.

MIDWINTER WEATHER CONDITIONS IN WESTERN ONTARIO.

By A. G. SEYFERT, Stratford, Ontario, dated January 26, 1904.

Not within the memory of the oldest inhabitant has western Ontario experienced such an unprecedentedly severe winter as this. Instead of the usual autumn rainfall, fine weather prevailed up to the middle of November, when it turned cold and commenced to snow, and has continued almost incessantly to the present time. Four feet of snow on the level and drifts in many places four times that depth result. Country roads are blockaded, and communication almost entirely cut off. Railroads are in but little better condition. The main lines are kept open, but many of the branches are completely snowed under and abandoned for the present. Every effort is being put forth in fighting the elements to keep the roads open, but never did such conditions prevail since railroads were first built in this province. The high winds, the intense cold, and the enormous quantity of snow are more than human agencies can overcome. The local papers are full of details of all sorts of accidents and fatalities attributable to the weather conditions. Roofs breaking down from the weight of the snow, people frozen to death within sight of their homes, freight trains loaded with live stock in snow drifts until the strongest

[1] Although many of these observations are not new to meteorology, yet the whole article is in the right direction, and we can only hope that Mr. Willsea may continue to observe and elucidate the important cloud phenomena.—ED.